DOCUMENT RESUME

ED 206 135 EC 133 589

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TITLE Sign Language for a Nonverbal Child: A Facilitator or Inhibitor of Vocal Speech?
PUB DATE Apr 80
NOTE 17p.: Paper presented at the Rocky Mountain Psychological Association Convention (Tucson, AZ, April 10, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Autism; Nonverbal Communication; *Sign Language; *Speech; Young Children

ABSTRACT

A 4 1/2 year old autistic-like child participated in a sign language training program using nine words, each with a corresponding toy and play activity. For each word the teacher held up the appropriate toy and said, or under the sign condition said and signed, the corresponding word. The S learned to sign, but the introduction of sign training had little of any effect on speech. Methodological considerations dictated that the only conclusion is that discriminative control was established for signing during sign training sessions and for speech during speech training sessions. The S learned skills (following instructions, imitating) during sign training which are often considered prerequisites to speech. (CL)

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Sign Language for a Nonverbal Child: A Facilitator or Inhibitor of Vocal Speech?

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Increasing numbers of nonverbal autistic and mentally retarded children are being taught sign language in an attempt to improve their communication skills. The successful acquisition of sign language by many of these children has generated research questions about the relationship between the development of sign language and the subsequent development of vocal speech.

Prior to the development of sign language programs, the speech training most commonly applied with autistic children was operant imitative speech training. Numerous program descriptions, notably those provided by Lovaas (1966), Baer, Peterson, and Sherman (1967) and Hewett (1965) have appeared in the literature. The basis of these programs is the establishment of imitative speech. Children are taught to imitate sounds which are later shaped into words and eventually sentences. One of the major inadequacies of this approach has been its failure to establish "spontaneous" speech. Children learn to speak but usually do so only in response to specific therapeutic settings and teachers.

The first documented sign language program for nonverbal children was developed by Margaret Creedon (1973). The program was based on the simultaneous presentation of spoken language and manual signs used by the deaf. In contrast to the teaching method applied by Lovaas and others, Creedon did not begin by teaching children to imitate. Rather, training was conducted by physically guiding the children's hands through the signs. Initial sign training focused on teaching children to name toys, foods or activities which were acquired by signing. The selection of the toys, foods and activities which the children signed for was based on each child's observed preferences in these areas. In training sessions, the teacher showed the child some item, for example a cookie, shaped the child's

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hands into the sign for cookie as she said "cookie", then gave the child the cookie. After the child learned a single sign, he was required to sign to receive the food or toy which the sign designated. After the children learned single signs, phrases and then sentences were taught. Children involved in this treatment were reported to sign to themselves, to sign to parents, teachers and peers and to produce a variety of sign sentences which they had not been directly taught. A few children began to vocally approximate words as they signed.

Although autistic and mentally retarded children had been included in language training programs for numerous years, documentation of extensive use of language outside of training settings or "spontaneous" language had been generally unheard of. As sign language became incorporated into language programs results similar to those reported by Creedon were noted. Children who had for years made no progress in speech therapy, learned to sign. In some cases very lengthy vocabularies were acquired and in most instances the development of "spontaneous" language was noted. Numerous researchers began to postulate that signing promoted "spontaneous" language.

Several years after Creedon's sign training program was presented, a group of researchers in Oregon directed by a man named Benson Schaeffer (Schaeffer, et al, 1976), became interested in studying the relationship between sign and speech. A language training program was developed in which three autistic boys were simultaneously given instruction in sign language and imitative speech training. Sign language training was modeled after the procedures developed by Creedon and imitative speech training was conducted with procedures similar to those developed by Lovaas (1966). By combining the imitative speech method with sign language training, Schaeffer and his colleagues eventually succeeded in teaching spontaneous speech. A brief summary of the procedures applied during this training and the results obtained has been provided by Schaeffer (1976). Referring to the three children involved in his program, he stated, "If the children are taught

sign language and verbal imitation, they begin integrating signs and sounds on their own. If they are then appropriately trained they integrate the skills completely, that is, learn to communicate simultaneously in signs and words. After many months of signed speech, the spontaneity promoted by signing transfers to speech and when the signs are faded out, spontaneous speech remains. (p. 39)"

The present study was designed to analyze the acquisition of sign language and the relationship between sign language and speech by identifying the conditions relevant to the establishment of these two forms of verbal behavior. A functional analysis of the variables controlling the production of verbal behavior has not been pursued in previous research dealing with the acquisition of sign language by nonverbal children.

A comparison of the rates of learning of imitative speech and imitative sign language was conducted in a single subject multiple baseline design. In a multiple baseline design, the experimental variable is applied to different behaviors, subjects or environments over staggered periods of time. A number of responses are measured to establish baselines against which changes can be evaluated. When baselines are obtained, the experimental variable is introduced to one of the several behaviors under study. Changes in the treated behavior or variable are noted. Little or no change should be observed in the untreated baselines upon the introduction of the treatment to the first baseline. The experimental variable is subsequently introduced to a second baseline and changes in that dependent measure are noted. This procedure continues until the experimental variable has been applied to all baselines. Consistent changes in the dependent variable after the introduction of the experimental variable are evaluated graphically or in some cases statistically, to determine the results of the intervention. In this study imitative speech training was the baseline condition and imitative sign language training was the experimental or treatment variable. The dependent

variables were the frequency and quality of imitative speech responses in both speech and sign training and the frequency and quality of imitative signs during sign language training.

By making speech sessions the baseline condition, vocal behavior prior to the introduction of sign language training was documented. Although previous studies indicate that the children involved in sign language training had been previously involved in speech training programs, no data have been presented on the frequency, type, or appropriate occurrence of vocal utterances prior to sign training.

The introduction of sign language into most programs has resulted in a number of concurrent changes not directly related to sign language. Teachers, parents and therapists often learn to sign as they begin to teach sign language to children. Sign language, implemented as manual communication or signed speech, requires that the teacher sign as he or she speaks. Teachers that are not fluent signers must often speak more slowly and in shorter sentences to be able to simultaneously speak and sign. In this study, rate of presentation of speech and sign was controlled by teaching the same single words in both speech and sign sessions.

Although Schaeffer et al (1976) compared speech training and sign training, the teaching procedures of the two sessions differed. In this study procedures during speech training and sign language training were identical with the exception of the introduction of the sign stimulus. This allowed evaluation of effects of sign language training, rather than the combined effect of sign language training with teaching procedures.

As noted, the frequency of occurrence of sign and speech responses was recorded. Each response was categorized as one of three types to denote the quality of that response. Speech responses were categorized as vocalized, approximate, or correct responses and signs were categorized as propped, approximate or correct responses. A vocalized speech response was recorded when the child made any sound not categorized as an approximate or correct response. An approximate speech response was recorded

when the child made a vocal response that included at least one of the speech sounds contained in the modeled word. A correct speech response was recorded when the child imitated the complete word. A propped sign response was recorded when the teacher guided the child's hands through the sign. An approximate sign response was recorded when the child moved his hands and arms within the appropriate sign plane in a movement that was similar to the teacher's model. Finger placement did not have to be exact. A correct sign was recorded when the child moved his hands and arms in the appropriate movement and held his fingers correctly. All responses had to occur within 10 seconds of the teacher's model to be recorded. A numerical quantity was assigned to each type of response so that the quality of responses recorded during each session could be averaged and evaluated as a single score. The number three was arbitrarily selected as the point value for a vocalized response and then each response (with the exception of a propped sign response) was assigned a numerical value by adding or subtracting six points to this base. No response received -3 points, a propped response received 0 points, a vocalized response received 3 points, an approximate response received 9 points and a correct response received 15 points. If the average speech response computed for a single session was in the -3 - 0 range, this meant that some vocalized responses were recorded but primarily no responses. If the average was in the 9 - 15 point range, the responses recorded during that session were primarily approximate and correct responses. The sign and vocal response averages for each session were graphically plotted by groups of words. Data were analyzed by visual inspection of these graphs.

METHOD

Subject

The child who participated in this study was a 4.5 year old male. The child was enrolled in a preschool training program and this research was conducted in conjunction with that program.

The child exhibited numerous autistic-like behaviors -- unresponsiveness to being called by name, infrequent eye contact, insistence on sameness, repetitive behaviors such as spinning and flapping and infrequent and unintelligible vocalizations. Vocalizations were usually uttered as the child gazed into space, tugged at his hair or clothing or ran from one area to another. The sounds were not paired with objects or people and were not consistently or predictably uttered. According to parental reports, the child's first words were at age ten months. At 18 months to two years speech became infrequent. There was no known medical illness associated with this regression and an audiological assessment indicated normal hearing.

Although the child was not speaking, he had developed a primitive communication method. He pulled or pushed the parent's or teachers' hands toward certain areas or objects. If the parent or teachers "misinterpreted" these gestures, a tantrum often ensued. Previous attempts at developing speech had been unsuccessful and the child was rarely observed to imitate any movement or vocalization. On occasion the child followed some simple instructions such as "sit down" and "come here". Motor development and coordination were at a general four year old level as assessed by the Portage Guide to Early Education (1976). Although there had been a failure to establish speech, the well developed motor coordination and the beginnings of a gestural communication system justified this child's participation in sign language training.

Procedures

The experimental variable, sign language training, was implemented across three groups of words. Selection of the words, or specific vocal responses that the child was instructed to make was based on 1) the utterances observed prior to the study and 2) the child's observed toy and activity preferences. Nine words, each with a corresponding toy and play activity, were selected and distributed into three groups of words each group containing three words. Speech and sign

production difficulty were considered and attempts made to equalize this variable across groups. The order of presentation of all words was randomized.

For each of the nine words included in this study, the teacher held up one of the nine toys and said, or under the sign condition said and signed the corresponding word. The child received the toy only if he made some vocal response, or in the sign condition a signed response, within ten seconds of the teacher's model.

Initially speech training was conducted with all words. After recording a very low frequency of speech responses for five sessions, sign language training was implemented with the first group of words. Speech training continued with the second and third group of words. When the child had correctly imitated the sign for each word in the first group at least twice, sign language training was introduced to the second group of words. Speech training continued with the third group of words. This procedure was repeated for the third group of words.

The procedures during baseline speech sessions were identical to those of the subsequent sign sessions with two exceptions. During baseline speech sessions the teacher said each word and the child was required to vocalize to receive the corresponding toy. During the experimental sign sessions, the teacher signed and said each word and the child was required to sign to receive the corresponding toys. Initially the teacher physically guided (propped) the child's hands through the sign, repeating the word vocally as she did so. The guiding was faded as the child began to independently approximate the signs.

As the study progressed, the child not only imitated the signs, but he began to sign some of the words as soon as the teacher presented the corresponding toy. This occurred prior to the teacher saying or signing the word. The occurrence of this type of sign and speech response was recorded when it occurred.

Towards the end of the study the child consistently signed almost every word. This prompted the experimenter to reinstate a separate speech training session. The training procedures of this session differed from those of the signing

sessions. The teacher presented the toy and said some part of the corresponding word -- the initial consonant, the initial consonant plus the subsequent vowel or the complete word. The actual sound presentation was determined by the child's responses.

RESULTS

As was observed in previous studies, the child involved in this study learned to sign. Figure 1 shows that after the vocal/sign stimulus was introduced, sign responses occurred frequently and increased throughout the study. Figure 1 shows further that the introduction of sign training had little if any effect on speech. A slight decrease in speech responses was noted in group three after the introduction of sign training but speech responses remained relatively constant in groups one and two.

As the study progressed the child began to sign and in some cases to say, the word corresponding to a particular toy as soon as that toy was presented but prior to any teacher instruction. This type of response is commonly referred to as "spontaneous language". The percent of vocal responses which occurred spontaneously during baseline speech training was 1.9%. 5% of the speech responses recorded during sign training were spontaneous responses and 16.6% of the sign responses were spontaneous.

As previously mentioned, separate speech training sessions were reinstated late in this study. Figure 2 shows the results of that training. The occurrence and quality of speech responses recorded during these latter speech sessions greatly superseded the occurrence and quality of speech responses recorded during the baseline speech sessions and the sign training sessions. 7.1% of the vocal responses recorded during this final speech training phase were spontaneous responses.

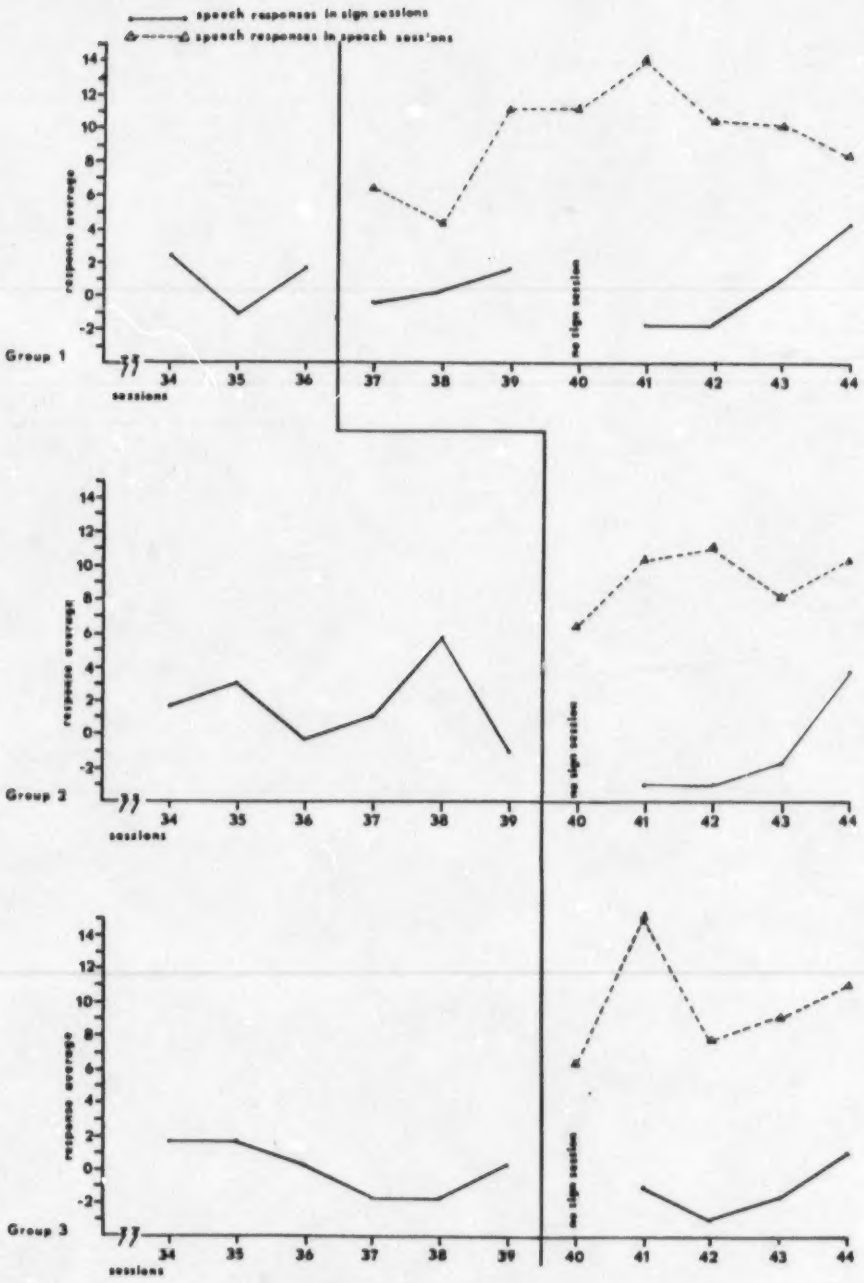

Figure 2. Speech and sign performance across conditions by word groups and sessions.

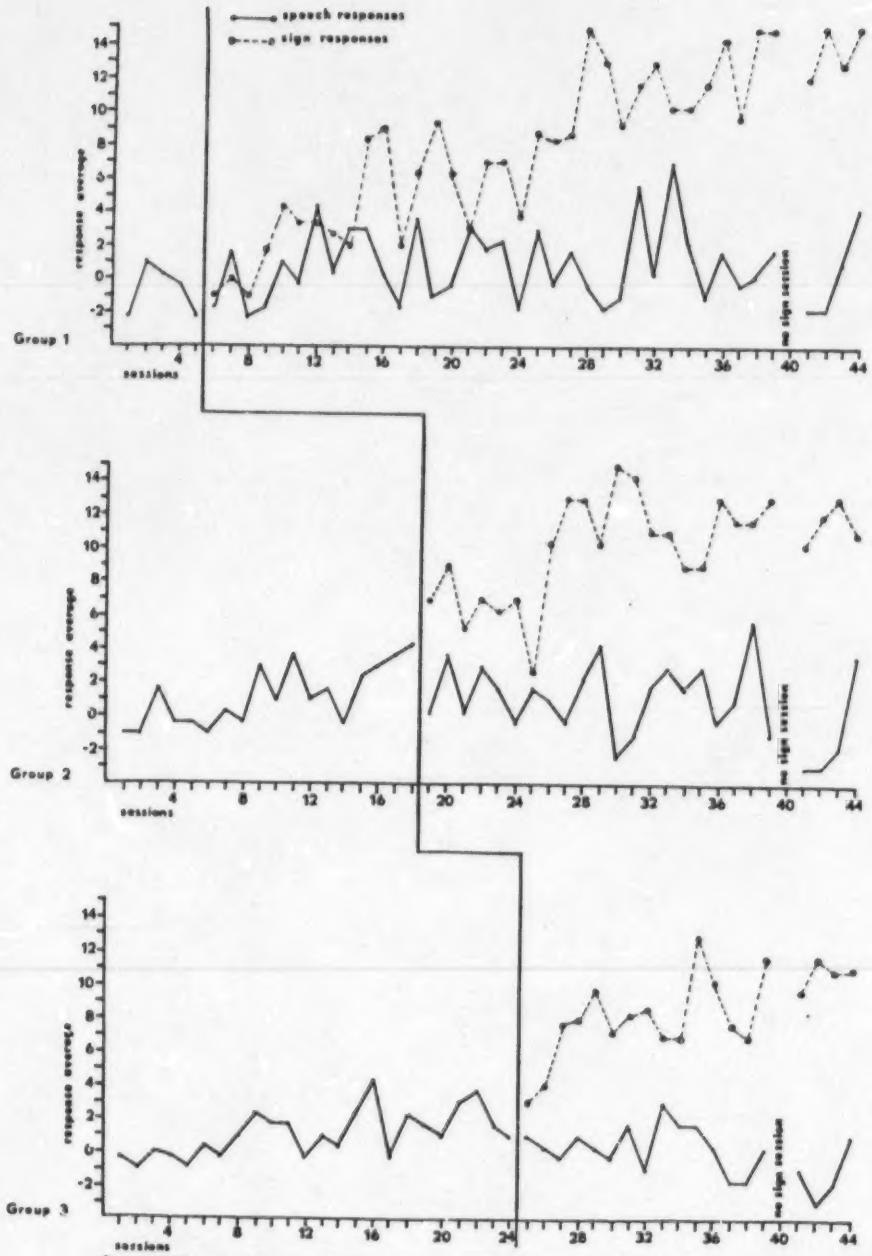

Figure 1. Speech and sign performance across conditions by word groups and sessions.

DISCUSSION

Failure to establish speech in the baseline speech sessions and yet the subsequent rapid establishment of the sign response suggest differences in these two modes of responding. Although some have suggested that a signed response is easier for a child to make than a vocal response, this distinction lacks precision. A behavioral analysis of the child's behavior prior to this study and of the procedures operating during sign training offers an alternate explanation.

Prior to this study the child uttered some sounds but these were infrequent and limited. To establish verbal behavior, a teacher must begin training by establishing control of the child's current responses. In this case this meant that the teacher had to get the child to make some sound after a model and follow that sound with reinforcement. With this child and many others, vocalizations were so infrequent that speech could not be established. Although the child's speech was very delayed, his motor development was basically normal. The child moved his hands and arms in innumerable ways without any specific training. These frequently occurring hand movements were very amenable to shaping.

Sign language differs from speech not only in the physical mechanisms required for its execution but also in its accessibility to the speaker's audience. We may see some of the lip movements associated with speech, but most of the speech response occurs inside of the individual. In contrast, the hand movements that form a sign are evident from the initiation to the termination of the response. When the teacher signed the child saw the sign. The sign response is accessible in another way as well. Since the speech response occurs internally it is not amenable to direct physical manipulation. Since the hand movements that compose a sign response are external movements, they can be physically manipulated. The teacher need not wait for a response to occur, but can begin shaping immediately by forcing the occurrence of the sign response. It follows that the sign response would be established prior to the speech response.

One of the questions investigated in this study was the effect of sign language on speech. Data indicated no change in speech responses as a result of the introduction of sign language training. A brief discussion of the reinforcement contingencies operating during sign language training may explain this result. Reinforcement in signing sessions occurred only after the child signed. If he vocalized but did not sign, he did not receive the toys. Under these conditions there would be no reason to expect an increase in speech responses. Indeed the contingencies of the sign sessions were such that eventual extinction of speech responses was very probable. It must be emphasized that if extinction had occurred, it would have occurred as a result of the operating contingencies, not as a result of the introduction of sign language.

Throughout discussions of language training techniques, the importance of developing "spontaneous" language is emphasized. We want the children we teach to talk or sign without being instructed by a teacher or parent to say or sign each word or sentence. In much of the language literature, verbal responses which occur in the absence of teacher instruction or models are referred to as spontaneous utterances. Although this experiment was designed to develop imitative verbal responses, behavior similar to what others have called spontaneous language was also established. An alternate interpretation of this behavior will be proposed.

When the teacher signed a particular word a number of other events also occurred. Immediately before the teacher signed the word, she also said it. This means that the child's signs and vocal responses occurred and were followed by reinforcement in the presence of the teacher, the teacher's signs, the teacher's speech and the toys. A discriminative stimulus function was established for this combination of events. Skinner stated that "any property of a stimulus present when a verbal response is reinforced acquires some degree of control over that response." (p. 107, 1953) Responses which occurred in the absence of a teacher

model did not occur spontaneously but were discriminated by at least one of the stimulus events most probably the presentation of the toys.

The introduction of the final speech training sessions was prompted by the child's success in the sign training sessions. Prior to the initiation of this study the child was rarely observed to imitate any response. After sign responses were established, the child imitated numerous movements. It was then that imitative speech training was successful. Since the difference in the occurrence of speech vocalizations prior to sign language training and in these latter sessions is so divergent, it is tempting to say that this child began to speak because he had learned to sign. There are several reasons why this conclusion is inappropriate. Speech training was not conducted throughout the study but was initially terminated upon the introduction of sign language training. A slight upward trend in speech vocalizations was noted in the baseline speech sessions prior to the introduction of sign language training. If the initial speech sessions had continued, perhaps the child would have been speaking by the end of the study at levels comparable to those obtained in the final speech sessions.

It is also important to recall the procedural differences between the baseline speech sessions, the sign sessions and these final speech sessions. During the baseline speech sessions and the final speech sessions the teacher said each word. In the final speech sessions the word was often presented in sound segments. In both speech sessions, only speech responses were followed by reinforcement. In the sign sessions the teacher said and signed each word but reinforcement occurred only after a signed response. When reinforcement was contingent upon sign production after the teacher's signs, the child signed. When these contingencies were reversed so that reinforcement followed speech vocalizations, a dramatic increase in speech vocalizations was recorded. This increase in vocalizations was recorded only during the speech sessions. Speech responses which occurred during the concurrent sign sessions did not increase above the levels recorded prior to the introduction of

these final speech sessions. The procedures of this study permit us to conclude only that discriminative control was established for signing during sign training sessions and for speech during speech training sessions. Although a cause and effect relationship can not be ascertained, definite behavior changes occurred during sign training which may have played a major role in the establishment of speech. During sign training the child learned many skills which are often considered prerequisites to speech development. The child learned to stay with the teacher during training sessions. He learned to follow instructions, to look at the teacher as she talked to him and to imitate many of the movements that the teacher made. As previously stated the child did not imitate any movements or sounds prior to this study. The establishment of imitative responses was an important part of the sign language training. Across all training conditions contingencies were such that reinforcement followed a response that topographically matched teacher modeled responses. Although each sign was technically a different response, they all had the common characteristic of being imitative responses. Skinner (1953) has described a process of abstraction whereby behavior is brought under the control of special properties of a stimulus and freed from control of other aspects of that stimulus. It is possible that teacher presented stimuli in the form of signs and sounds established control of imitative responses. That is, the child learned to imitate signs he had been specifically taught to imitate and then when presented with a new word or sign would imitate this word or sign without specific imitation training. The procedures of this study do not permit one to conclude that sign language facilitates speech. The effects of sign language training that have been described in the literature and this paper reflect the multiple contingencies operating in the training environment. To separate these contingencies from sign language itself and postulate that "sign language" possesses special qualities that promote speech acquisition is impossible.

Although it is this writer's conclusion that sign language neither directly facilitates or inhibits speech development it may be an intermediate step in the establishment of speech for children with minimal speech but normal or near normal motor development. Discriminative control of sign responses can be shaped more quickly than discriminative control of speech because of the accessibility to the sign response. Procedures outlined by Schaeffer, et al (1976) provide a method whereby discriminative control can be shaped or transfered from signs to speech. The results of this study support such a speech shaping program.

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